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PAPERS

IN

COLONIES AND TRADE.

The GOLD MEDAL, *was this Session voted to Lieut. Col.* BOUCHETTE, *of Canada, for an extensive Map of Canada. The following Communications were received from him, and the Map is preserved in the Society's Repository.*

SIR,

I HAVE the honour of transmitting to you a complete set of my topographical maps and description of Lower Canada, for the purpose of laying them before the Society for the Encouragement of Arts, Manufactures, and Commerce.

As I am about to leave England very shortly, it would prove peculiarly grateful to me, were the Society to take it under consideration, and express an opinion upon it at an early period. Having received from his Majesty's government the appointment of a Surveyor to Commission for settling the boundaries between the British colonies in North America, and the United States, in fulfilment of the late treaty of peace; I shall, of course, in the performance of that duty, pass over an extensive tract of country, much of which is not very well known in Europe; I beg leave therefore to offer my services to the Society, (if it is considered that any information may be obtained for it) in whatever way it may be pleased to direct my attention, and my humble abilities can atchieve.

I have the honour to be, Sir,
Your most obedient humble Servant,
JOSEPH BOUCHETTE.

No. 42, Dorset Street, Portman Square.
Feb. 17*th*, 1816.

To C. Taylor, M.D. Sec.

The following are the Extracts from the Minutes of the House of Assembly, dated

Quebec, 15*th Feb.* 1814.

" Resolved—That the Petition of Joseph Bouchette, Esq. Surveyor General of the Province of Lower Canada, with a Prospectus accompanying the same, be referred to a Committee, of five Members, with power to send for persons and papers."

" Resolved—That Mr. Lee, Mr. Papineau, Mr. Tachereau, Mr. Mure and Mr. Bellett, do compose the said Committee."

(Signed) W. LINDSDAY, Chairman.

Committee Room, Friday, 18*th*, *Feb.* 1814.

" In committee on the Petition of Joseph Bouchette, Esq. Surveyor General of the province of Lower Canada, present,

Messrs. Lee, Papineau, Bellett, Taschereau.

" Mr. Taschereau called to the chair.

" Read the order of reference.

" The committee examined Mr. Bouchette.

" Mr. Bouchette untertakes within twelve months to produce the maps and the book mentioned with list hereunto annexed."

" That the expences necessary for effecting the engraving of these plates, and the printing of the book, will amount to 1500*l.*"

" Your committee also examined the maps which the said Joseph Bouchette proposes to publish, and to which he intends to make additions."

" Your committee having taken into consideration the whole matter, is of opinion, that the publication of these maps would be of very great utility to government, and to the province, and ought to be encouraged by the legislature, by the grant of a sum of money, to be placed in the hands of commissioners, and applied under their direction, to the publication of the said maps."

" The whole nevertheless humbly submitted."

(Signed) J. TASCHEREAU, *Chairman.*

In a Committee of the whole House.

" Resolved—That it is the opinion of this Committee, that the sum of fifteen hundred pounds currency be applied, under the direction of commissioners, to encourage and assist Joseph Bouchette, Esq. in publishing the topographical and geographical maps of the province."

House of Assembly, Tuesday, 23d Feb. 1814.

" In committee of the whole house, on the report of the Special Committee, to which was referred the petition of Joseph Bouchette, Esq. Surveyor General,"

Mr. Denechaud called to the chair.

"1st on the motion of Mr. Taschereau, seconded by Mr. Lee.

"Resolved—That it is the opinion of this Committee, that a sum of fifteen hundred pounds currency be applied under the direction of commissioners, to encourage and assist Joseph Bouchette, Esq. in publishing the topographical and geographical maps of the province."

On the motion of Mr. Taschereau, seconded by Mr. Pozer, ordered that the chairman do leave the chair, and report the said resolution.

Attested. W. Lindsday, &c,

Dear Sir;

The Lords Commissioners of the Admiralty permitted me to subscribe in their names for twelve copies of your very scientific and elaborate survey of the Canadas; as well as for 100 sets of that part thereof which includes the St. Lawrence River, for the general supply of such of His Majesty's ships as may be employed in that part of the world. I trust you will receive this mark of their Lordship's favour as a proof of the high estimation in which the Board, as well as myself, hold the skill and abilities you have exhibited in the construction of those maps, and in their accompanying description.

Your publication must have been made at a great expence, and that it may be attended with all the success you so highly merit, is the sincere wish of, Dear Sir,

Your most obedient humble Servant,

THOMAS HURD,
Hydrographer to the Admiralty.

Hydrographical Office, Admiralty,
Feb. 20th, 1816.

To J. Bouchette, Esq. &c.

GENTLEMEN,

BEING an invalid prevents me the honour of attending your Committee this evening on the subject of Colonel BOUCHETTE's map of Lower Canada.

The map speaks so strongly for itself as to preclude the necessity of any remarks to point out its merits. This map has evidently been compiled with great care and attention, from the official plans and other topographical documents deposited in the Surveyor General's Office at Quebec, which, combined with Colonel BOUCHETTE's local knowledge of the country, has enabled him to construct a very intelligent map of that interesting province, on a large scale exhibiting the various features with clearness and precision; it is elegantly engraved and printed at a considerable expence, accompanied with a copious topographical description, and is justly worthy the sanction of your honourable Society.

I am, Gentlemen,
Most respectfully,
Your obedient Servant,
WM. FADEN.

Charing Cross, March 9th, 1816.

To the Society for the Encouragement of Arts, &c.

SIR,

AGREEABLE to your request, I have much satisfaction in bearing testimony of the zeal and diligence with which you have brought forward your map of the Canadas, a work which cannot fail to be of great importance both in a civil and military point of view; and I am fully sensible that no exertions have been spared on your part to render it ample and correct.

I have the honour to be, Sir,
Your very humble Servant,
CHRISTOPHER MYERS,
Colonel; D. Q. Master General, Canada.

London, March 8th, 1816.

Lieut. Col. BOUCHETTE.

The GOLD ISIS MEDAL *was this Session voted to* THOMAS HOBLYN, ESQ. *of Sloane Street, for preparing Rice in the Isle of Ceylon. The following Communication was received from him, and Drawings of the Machinery are preserved in the Society's Repository.*

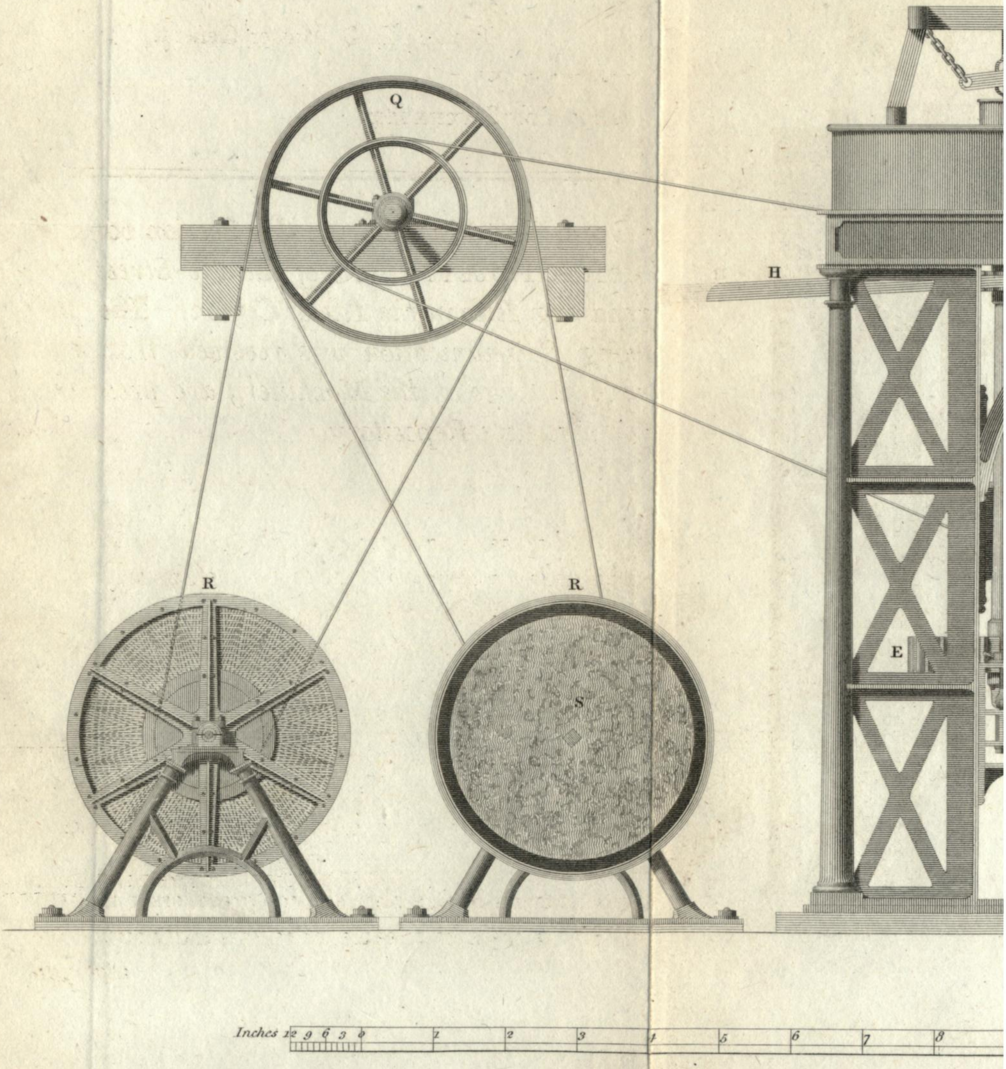
SIR,

THE object of sending out machinery for the cleaning of rice was to effect a saving of labour, as well as to prevent the great loss sustained by breaking the grains.

The present plan, practised by the Cingaleze, is probably one of the rudest inventions in nature; it consists of a large mortar, with a pestle, suspended to a lever, and by a constant repetition of blows upon its contents after twelve hours labour, half only will be found fit for the table; the rest is applied to the feeding of poultry and other domestic purposes.

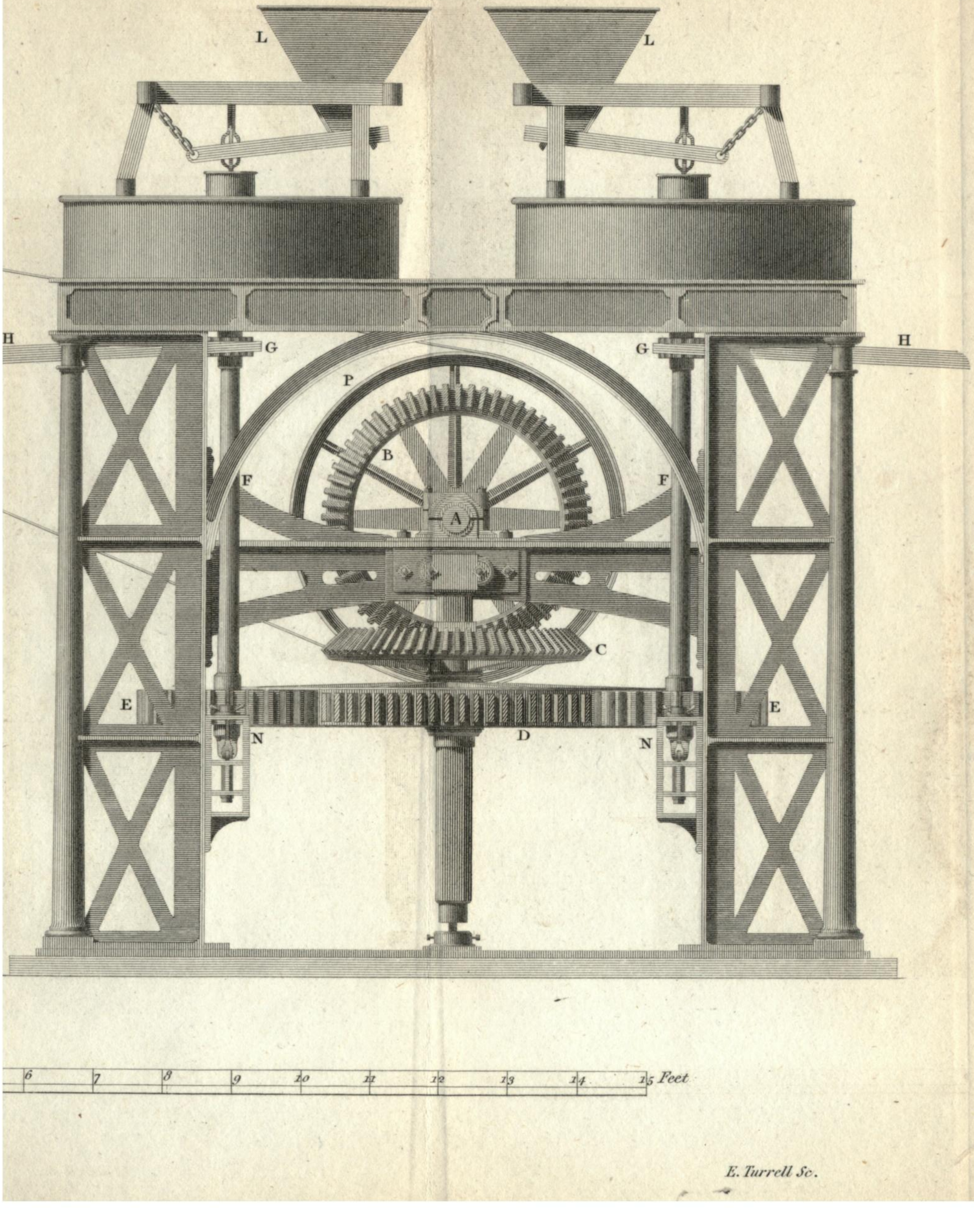
The tediousness of this plan, and the great loss in the conversion of the grain to saleable price, naturally struck the attention

Mr. Thomas Hoblyn's Ric



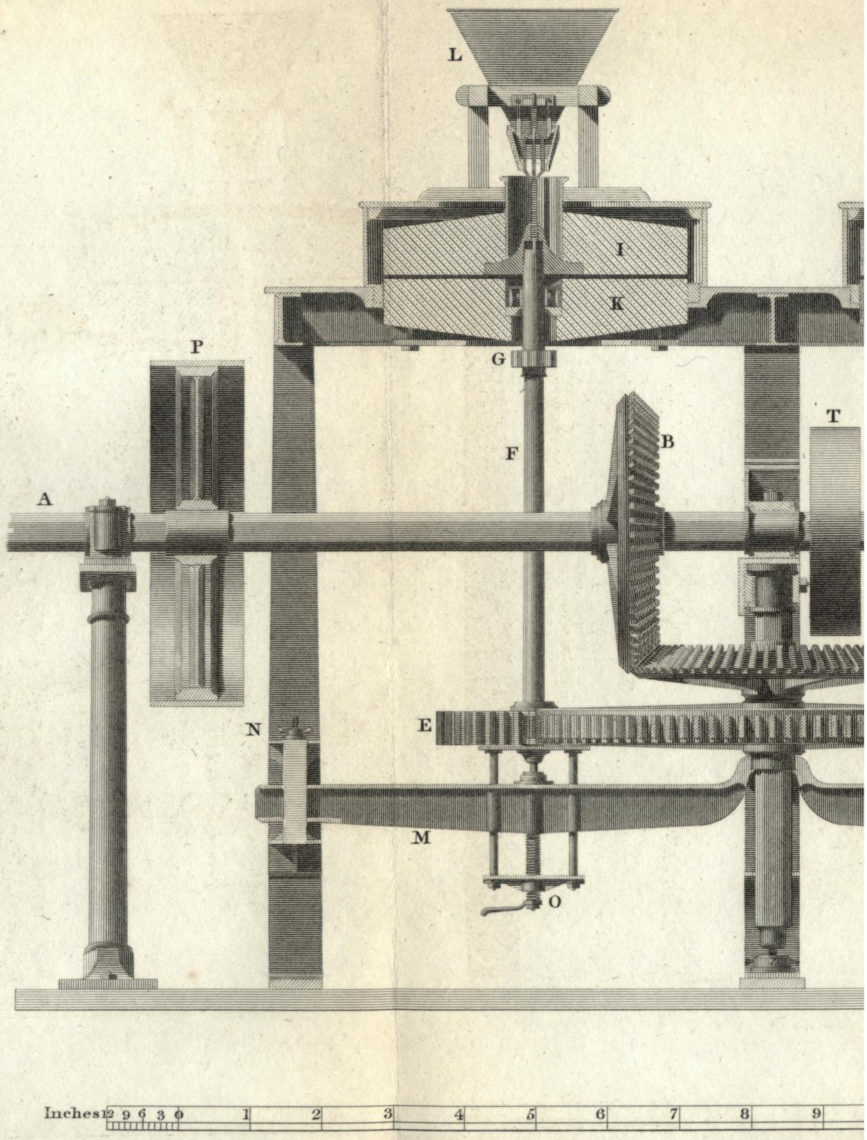
J. Clement del.

Hoblyn's Rice Mill. No. II.



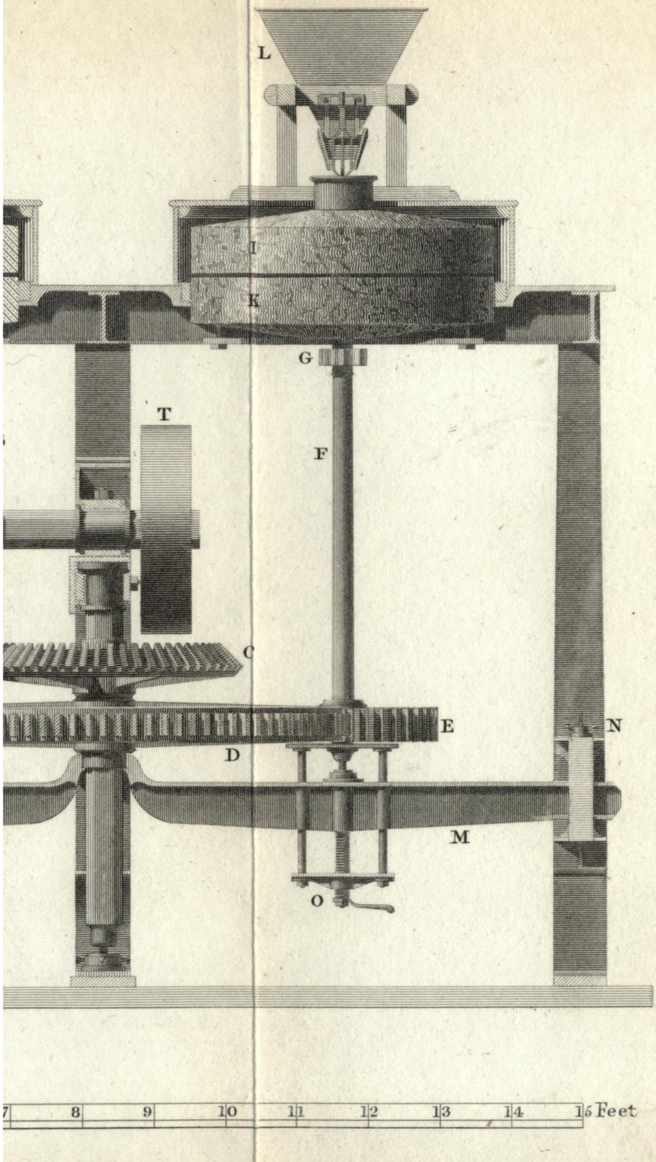
E. Turrell Sc.

Mr. Thomas Hoblyn's Rice Mill.



J. Clement del.

Rice Mill. N°. 1.



Ed. Turrell Sc.

attention of the late Governor General Sir Thomas Maitland; and having strongly recommended, upon his return from Ceylon, that some better mode should be introduced for this purpose, His Majesty's Secretary of State for the colonies was interested in its adoption, and instructed the Right Hon. William Huskisson, colonial agent for the island, to take measures for effecting this important improvement with the least possible delay. Circumstanced as I then was, and still have the honor to be with my friend Mr. Huskisson, it fell to my immediate superintendance to carry the plan into effect, and having a great delight in all matters relating to mechanics and machinery, I felt a great degree of pleasure in forwarding a plan which appeared to me so truly desirable, and likely to be attended with the most satisfactory results.

Mr. George Atkinson, the late civil engineer, was prepared with a plan, but, as his process was a mere extended adoption of the existing system, and by no means prevented the breakage of the grains and consequent loss, he considered my view of the case as more likely to answer the end in question, and rendered me every assistance in his power to effect its completion.

Instead of the breaking system, it occurred to me that trituration might be successful; and, under this impression, I had several experiments tried in corn-mills, and particularly in the sort of mill where oats are husked for the making of grits. This answered tolerably well in detaching the outside shell, but it had no effect whatever upon the fine cuticle which surrounds the grain, after this has been removed; it was then found necessary to have recourse to some other plan to render the grain perfectly white, and, after several ineffectual experiments, the mode now practised was that which was (and which will be hereafter explained) fixed upon as being the means of most effectually compleating the process.

Having thus far explained the progress of the intended improvement, it will now be necessary to have recourse to the plans and elevations for the establishment.

The Ground-Plan of the Building; the end and side-Views; and the enlarged Drawings of the Mill-Work and Presses.

The rice-mill was constructed by that most ingenious and indefatigable engineer, Mr. Henry Maudsley, of Lambeth, whose exertions in carrying into effect Mr. Brunel's ideas with respect to the block-machinery at Portsmouth were too fresh in my recollection not to prefer him before any other engineer in London for this part of the establishment. The apparatus for making the oil was constructed by the late Mr. Joseph Bramah, in whose recent death the public have lost a most valuable member of society; but he has left behind him a monument of inventions which must preserve his ingenuity and talents in the recollection of all those who had the pleasure of his acquaintance.

The mill consists of a strong iron framing, supporting by columns a platform about twelve feet square, and ten feet high; upon this platform there are placed at equal distances four pair of horizontal stones, four feet six inches diameter, driven by wheel-work contained under the platform, and supported by a framing of iron fixed to the columns. The mill is placed at about ten feet from the fly-wheel of the engine, and receives its motion by a shaft coupled on the end of that which carries the fly wheel, having a bearing from its other end on the framing of the mill; on this shaft is a bevil or mitre-wheel four feet diameter, with cogs, working in another of the same size on an upright shaft in the very centre of the mill; there is also on this upright shaft a spur-wheel, seven feet diameter, working like the last-mentioned bevil-wheel, horizontally; this large wheel has cogs or teeth in its rim which work into four pinions or small wheels, two feet six inches diameter, fitted on the spindles of the stones, and drives the four pair at once; all this wheel-work is so proportioned, that when the engine makes thirty revolutions, the stone makes 84.

The under stone remains stationary, being wedged part into a circular hole in the platform; in the centre is a hole through which the spindles come from below; in this hole a brass socket is fixed to prevent the spindle from wearing, and the upper end of the spindle stands six or seven inches above the stone.

The upper surface of the stone being made perfectly flat and true, and laid quite level, it is punched full of small holes about a quarter of an inch deep, and three quarters of an inch apart.

The upper stone or runner is prepared in the same manner, and exactly balanced on the top of the spindle, with its under surface fitting perfectly true to the upper surface of the nether stone. The whole or the centre of the upper stone is large, and has a cross fitted in it to form the centre socket which fits upon the spindle, so that between the arms of this cross the grain turned in can fall upon the nether stone round the centre.

The stones being thus prepared, and the mill in motion, the upper stone revolves with great velocity, while the nether stone is fixed; the lower end of the spindle or pivot on which the stone turns is planted upon a strong iron lever, which can be raised or lowered by a screw, and by this means the falls of the stones can be adjusted by the miller either when the mill is in action or motionless, with the greatest possible facility.

The stones are covered by a hoop or case, which entirely encloses them, leaving a space all round between the stone and the hoop of about two inches; on the top of the case is fixed the hopper, which is filled with paddy; it falls through a hole in the bottom of the hopper into a shoot, and is conveyed into the hole in the centre of the upper or running stone; it then falls through the arms of the cross before described upon the face of the nether-stone round the centre. The stones being in rapid motion, the paddy finds its way between the faces of the two stones which are now supposed to be set at about the length of the grain apart; the grains are carried by the centrifugal force from the centre to the extremity of the stones, and thrown out in all directions into the case or hoop which surrounds the stones; in one side of this hoop is a hole through which the rice in this state runs out.

The stones should be set, in the first instance, with great care, for if they are too near, the rice will be broken, and if too far apart, the paddy will get through without being touched; but, when set at the right distance, the husk will be completely taken off, and the rice not broken.

One pair of stones will husk from eight to ten bushels an hour with ease; it runs from the cases upon a fine sieve kept agitated by the mills; in passing over this, the dust and sand are separated; it then falls into the winnowing machine, which is to separate the husk from the rice; this is done by causing the husk and rice together, as they left the stones, to fall in a gentle stream through a current of air excited by a succession of fans revolving upon an axis, and driven by the engine in its passage through the current; the husk being much lighter than the rice, is blown away, and the rice falls into a bin below.

There is one of these Machines to each pair of stones, to separate the rice from the husk, in its passage from the stones to the bin; this part of the operation is most completely performed, and keeps pace with the stones.

The rice in this stage of the operation, is more or less red, nothing more being done than the separation of the husk; after this, it is taken to the whitening machine, where the inside cuticle, or red skin is detached.

This Machine consists of a stone of coarse grit fixed on a spindle like a grinding stone; the stone is inclosed in a box or case made nearly to fit, leaving a space all round of about an inch between the stone, and the inside of the case; this case is made of plate iron, and punched full of small holes like a grater, with the rough side inwards; it is so contrived, that the case may go round with the stone, or it may remain still while the stone is turning.

The rice is put in between the case and the stone, at a sliding door or opening in the rim; the space is about two-thirds filled; the stone is then put in very rapid motion, at least 250 revolutions a minute, by a strap; the case is allowed to turn very slowly; this changes the position of the rice, and every grain in succession comes into contact with the stone, and, rubbing hard against each other, an accumulation of heat, (which produces an enlargement of the grain, and consequently splits the red skin,) is produced, which serves to loosen the skin; and, this forming a red dust, finds its way out of the holes in the case, and leaves the rice perfectly white.

In the whole process there is a little or no loss, for when the stones are well adjusted, very few grains are broken, not more perhaps than 5 per cent. upon the whole, and those very partially.

The rice-mills were set to work in Ceylon on the 1st of October, 1814; and from the report I have received from Mr. Joseph Atkinson, who was sent out to Ceylon to superintend their erection, they perform the mill-work in an unexceptionable manner; and I have no doubt, will prove of the greatest possible advantage to the Island.

As a means of forming some judgment of what this saving will amount to, it may probably be considered interesting to the Society to be furnished with a statement of the produce of the rice in the different districts of Ceylon, which has been furnished to me by Lieutenant-Colonel Edwards, late military secretary to the governor of Ceylon, from the official documents in his possession.

During the whole of General Maitland's government in Ceylon, he turned his attention most particularly to the increase of the cultivation of grain which has been imported for a series of years in large quantities from Bengal, and the coast.

The prejudices of the inhabitants in the Cingalese districts render them averse to any changes in their established modes although likely to be attended with the most beneficial effects, and the General was obliged to have recourse to the Malabar districts, to carry into effect the measures which he had in contemplation, for improving the cultivation, or bettering the condition of the inhabitants.

Owing to the wise system which he adopted, of government taking an active superintendance over the districts, of furnishing the cultivators at moderate prices with seed, paddy, iron for their tools, buffaloes for tilling the land, and clothes for their families, which they were to repay upon gathering their crop, and which they had hitherto procured at most enormous rates from itinerant Moormen; the whole of the Malabar side of the island rapidly improved with regard to its cultivation, as will be best seen by the following.

Comparative view of the produce of paddy in 1806, the year after the General's arrival in Ceylon, and in the year 1811, that of his departure.

	1806	1811	Increase.
Batticolo Parrahs,	19,016	71,578	
Trincomale,	3,529	10,000	
Wanny,	6,702	40,000	
Jaffuse,	66,570	94,000	
Munar,	33,362	40,000	
	128,909	255,578	126,529 Parrahs

The above is merely a statement of the tythes of government, consequently, the produce was ten times that amount, and the total increase of cultivation in five years was, in the Malabar districts, 1,265,295 Parrahs, or, upon the most moderate calculation 180,755 bags of rice, being worth at 9 R. dollars per bag 1,626,795 R. dollars.

From what is above stated, it will be seen, that, in the year 1811, the produce of the district of Batticolo alone was 715,780 parrahs of paddy. and Mr. Sawyers, then agent of the revenue, calculated, that in two years the cultivation of grain would be so much increased as to lead to a reasonable expectation, that 1,000,000 parrahs would be grown in the district.

The following short calculation will at once shew the great difference between the two modes, and will prove the real advantage which will arise from the more general use of engines of this description.

By the experiments made in this country with the two steam engines lately sent to Ceylon, it was found, that allowing them to be worked ten hours each day, and admitting 300 working days in the year, they would convert annually 576,000 parrahs of paddy into a quantity of rice equal to 147,347 bags, which at 9 R. dollars per bag would amount to 1,326,123 R. Dollars, or, at the par of exchange of 1*s.* 9*d.* per dollar to *L.* sterling 116,035 15*s.* 3*d.*

The converting the same quantity of paddy into rice by by the common method would produce only 82,285 bags which at 9 R. dollars the bag would amount to 740,565 R. dollars equal to 1*s.* 9*d.* each *L.* 64,799 8 9

Thus making a saving in one year of *L.* 51,336 6 6

From this must be deducted upon 576,000 parrahs of paddy a proportion of the original cost of the engines, and the annual expence of working and keeping them in order: but this deduction will be considerably lessened, if not totally done away, by a comparison with the actual expence of beating the paddy into rice by the common stamper, which is either defrayed by an allowance of wages for the labour or by a grant of paddy. Admitting, however, the excess of the expence of the engines, to be 5000*l.* annually, which is considerably more than it can possibly amount to, the net gain would be 45,236*l.* 6*s.* 6*d.*

It will be seen from what has been already said, that two engines, similar to those sent to Ceylon, would be at least required for the produce of the district of Batticolo alone, it yielding nearly a million of parrahs:—Another might be, with great propriety erected at Jaffnapatam, which produce 940,000 parrahs; and a fourth at Columbo, where an equal quantity may be calculated upon. There is every reason to conclude, that while they would be the source of considerable profit to government, they would prove of the greatest advantage to the inhabitants, and to the general prosperity of the island.

It would be desirable that a pair of edge stones and some appropriate machinery for sawing timber should be attached to each mill where the district afforded either cocoa nuts or hard woods, by which means an additional advantage would be derived to government, and might possibly lead to the establishment of individuals there, whose enterprise and exertions might be attended ultimately with the greatest possible advantage.

The oil mill is composed of a common pair of edge stones drawn by a shaft from the rice-mill, and the pulp is put into hair bags, and pressed in the hydrostatic apparatus, as will be seen by reference to the plan.

Mr. Atkinson's report upon this part of the establishment fully answers my expectations, I would have wished, however, that he had been rather more explicit, but he concludes his statement with this observation, that, by grinding the cocoa nut, and submitting it to a pressure, a larger quantity of oil can be produced, and in much less time than by the present mode.

I have the honour to be, Sir,
Your obedient Servant,

THOMAS HOBLYN.

Treasury Chambers, 25th Nov. 1815.

To C. Taylor, M. D. Sec.

Reference to the Engravings of Mr. T. HOBLYN'S *Rice Mill. Plates* 31, 32.

A, is the horizontal shaft, driven by the steam engine, on which is fixed B, a bevil wheel four feet in diameter, working into C, and another bevil wheel of the same diameter, on the vertical shaft of which is a spur wheel D, of seven feet in diameter, which works into four pinions on the spindles of the upper mill-stones, two of which are shewn at EE, each of two feet six inches in diameter.

FF, spindles of the upper mill-stones, having indented pinions, GG, near their tops for the purpose of agitating the sieves: HH, shewn in drawing No. 2: II, in drawing No. 1, the upper mill-stones: KK the lower mill-stones: LL, the hoppers: MM, in drawing No. 1. the iron levers on which the spindles of the upper mill-stones are planted, and which can be raised or lowered, to adjust the stones by means of the regulating screw NN :OO, in drawing No.1, are screws to raise the pinions EE, and cast them out of gear: P, is the drum for driving, by means of a band, the multiplying wheels Q, shewn in drawing No. 2, which give motion to the blanching machines RR, one of which is shewn in elevation, and the other in section, in which S, is the revolving stone: T, in drawing No. 1, is a drum for working the winnowing machines.

Fig. 4.

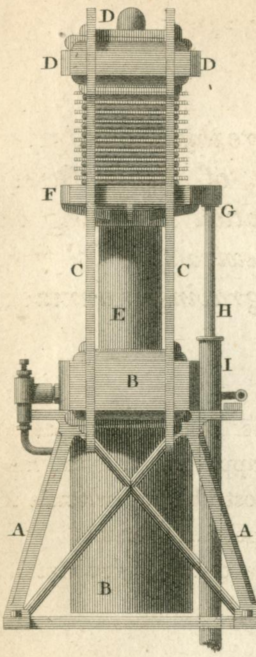


Fig. 1.

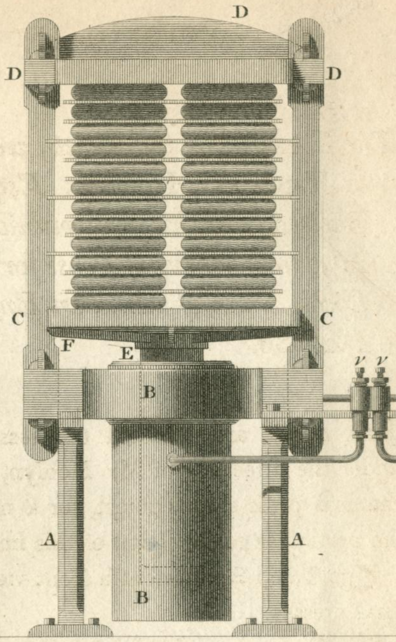
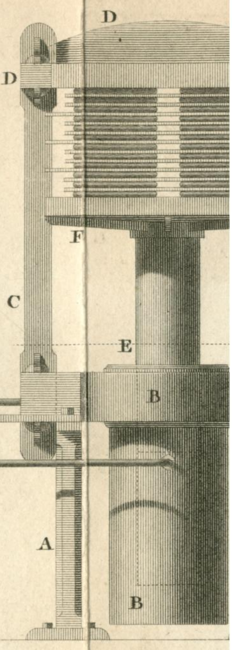


Fig. 2.



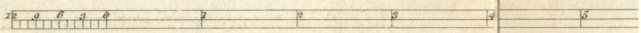


Fig. 10.

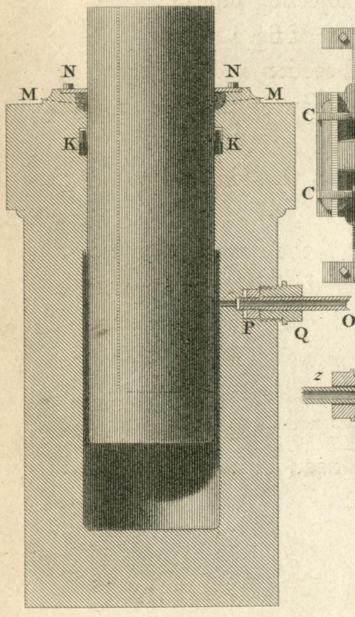


Fig. 6.

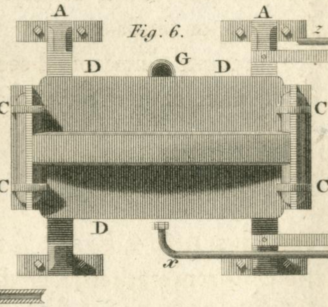


Fig. 7.

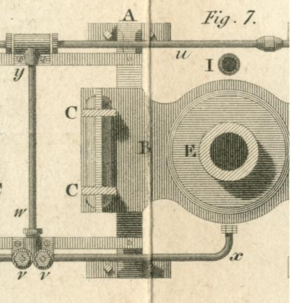


Fig. 14.

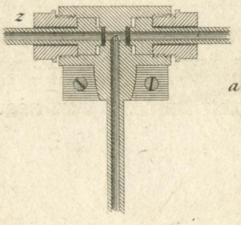


Fig. 15.

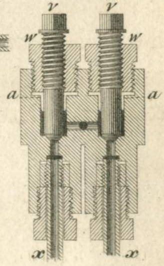
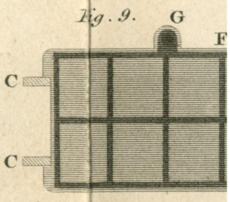


Fig. 9.



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Mr. T. Hoblyn's Oil-Press.

Fig. 2.

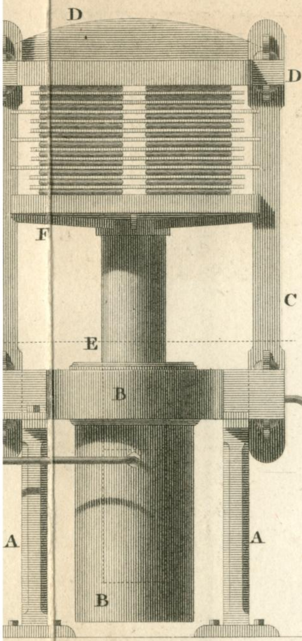


Fig. 3.

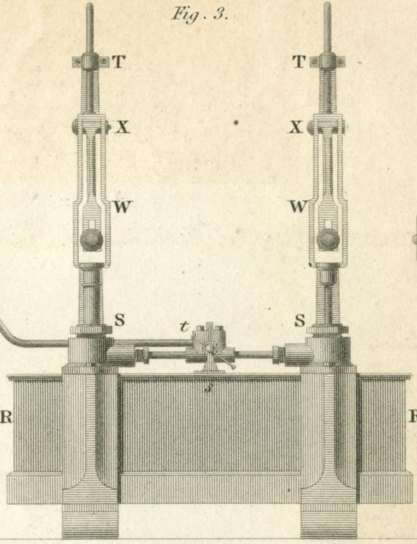


Fig. 5.

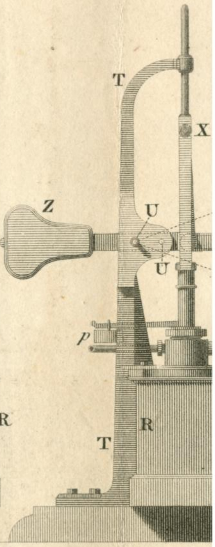


Fig. 7.

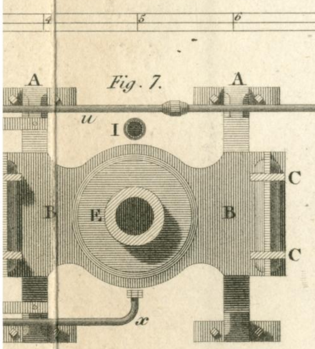
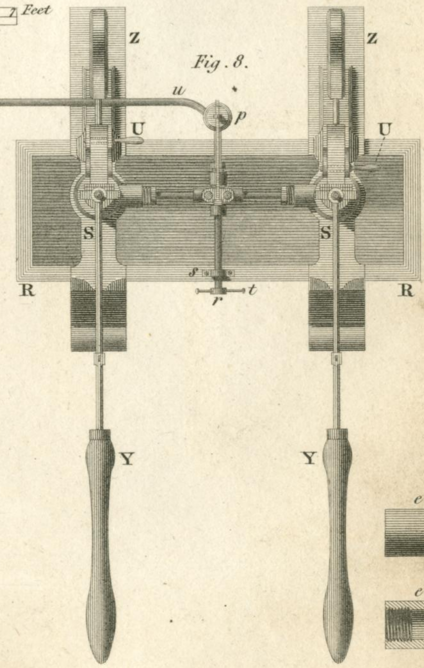


Fig. 8.



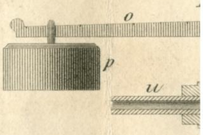


Fig. 26

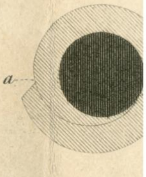


Fig. 9.

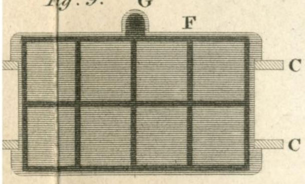


Fig. 16.

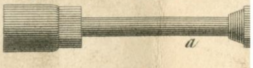
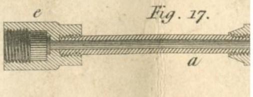
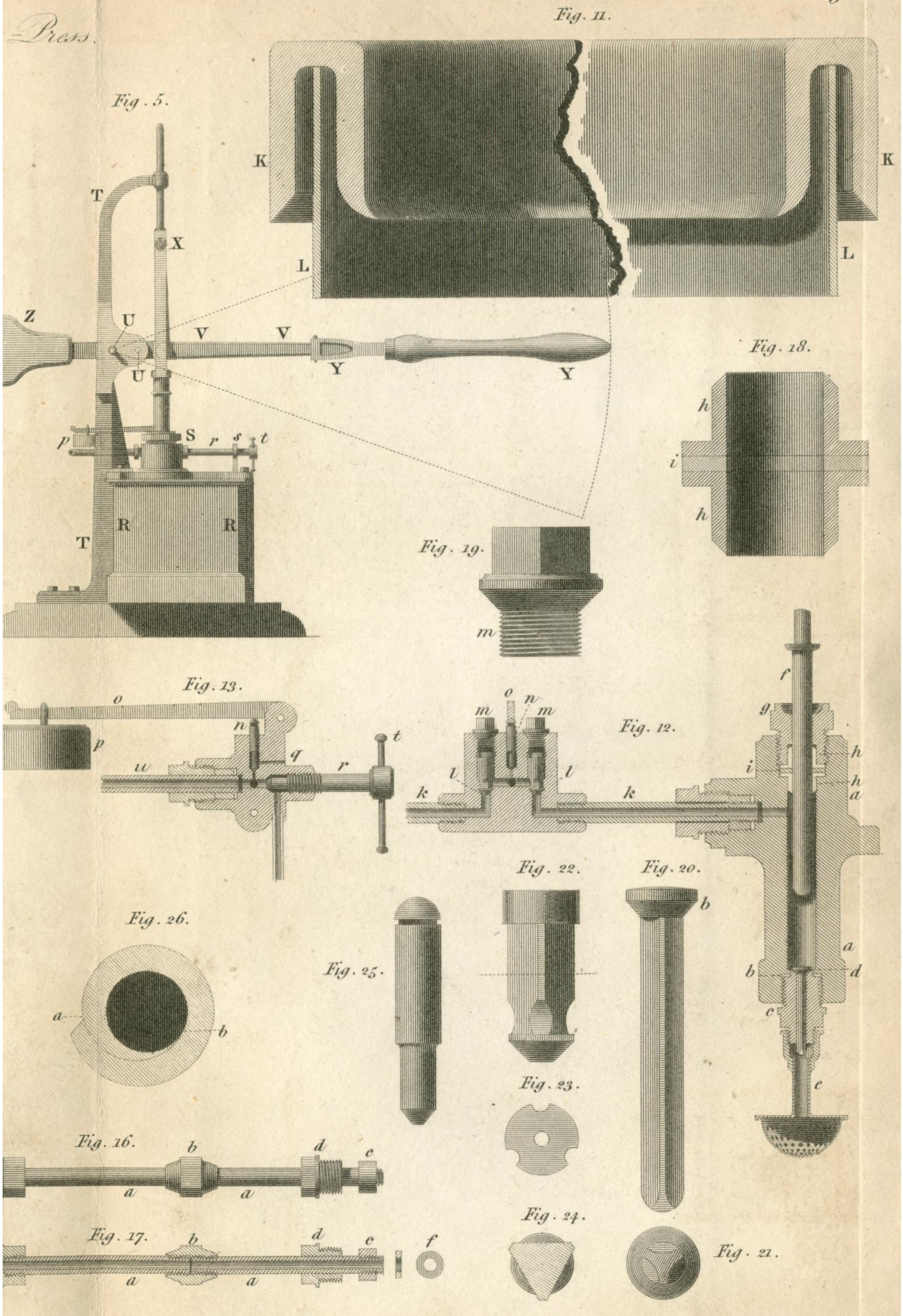


Fig. 17.



Press.

Plate 30.



Ed. Turrell sc.

The THANKS *of the Society were this Session given to* THOMAS HOBLYN, *Esq. of Sloane Street, Chelsea, for his Communication respecting an Hydro-mechanical Press for extracting Oil from Cocoa Nuts, of which an Engraving is annexed, Plate* 30.

THE public are indebted to Messrs. Bramah, who have, under the directions of Mr. Hoblyn, applied their hydro-mechanical press to this object, for a most liberal disclosure of the particular construction of this important machine.

Figs. 1 and 2 represent a front view of two hydro-mechanical presses.

Fig. 3, the two injecting pumps.

Fig. 4, represents an end view of the press, fig. 2.

Fig. 5, is an end view of the injecting pumps.

Fig. 6, a plan or bird's-eye view of fig. 1.

Fig. 7, represents a horizontal section at E, of fig. 2.

Fig. 8, a plan or bird's-eye view of the two injecting pumps.

N. B. The same letters refer to the same parts in each figure.

AA, AA, figs. 1, 2, 4, 6, and 7, the frames, each consisting of two cast-iron brackets, on which the two presses are fixed: BB, figs. 1, 2, 4, and 7, the press cylinder, made of cast-iron, and likewise forming the bed of the press, at each end of which are fixed two wrought-iron bars, CC, figs. 1, 2, and 4, and CCCC, figs. 6 and 7; at the upper ends of these bars is fixed the cast-iron head of the press, DDD, figs. 1, 2, 4, and 6: E, figs. 1, 2, 4, and 7, the press piston, the ascent and descent of which constitutes the action of the press: F, figs. 1, 2, and 4, the follower, made fast to the upper end of the piston, and guided at each end by the bars, CCCC, parallel with the cylinder. On the upper side of the follower are placed two rows of woollen bags filled with the ground pulp of the cocoa nut kernels, and having between each of them wrought-iron plates, every third of which is made longer than the others, and has two gaps in each end of it, to receive and be guided by the four bars of the press, CCCC.

Fig. 1, represents the press filled with bags, ready to begin to work; figs. 2, and 4, the bags compressed, the oil making its escape through them, and running over the edges of the plates, down to the followers, on the upper sides of which are channels made to receive and convey the oil to a hole in the follower, to the under side of which is fixed a copper tube, which receives the oil, and ascends and descends along with the piston, in another tube or pipe, as shown in fig. 4, at G, H, I; these channels and the hole, G, are fully shown in fig. 9. The pipe I conveys the oil to the reservoir.

All the beforementioned figures are drawn to a scale of half an inch to the foot.

Fig. 10, represents the piston and a section of the cylinder, drawn on a scale of one inch to the foot. The upper end of the cylinder has a recess, KK, turned within it, to admit a double ring of leather kept distended by a metal ring, which renders the junction between the working piston and its cylinder water-tight.

Fig. 11, is the double cupped leather, shown of its real size; the middle part, however, being removed to save room in the plate; KK, shows a section of the leather, the edges of it being cut to an angle of forty-five degrees, and the edges made thin to embrace the piston, and be brought into contact with the inside of the recess in the cylinder, so as absolutely to prevent the escape of the water either way: LL, is the copper ring, to sustain the leather when the piston is pressed down, and to prevent its edges from being injured by being brought into contact with the bottom part of the recess.

In the upper part of the cylinder a channel, MM, fig. 10, is also made, which is filled with tow or any other soft packing, impregnated with sweet oil, and which is confined by a plate or ring of cast-iron, NN, lying upon it. This packing serves at once to supply the cylinder with oil, and to prevent the admission of any substance which might injure the surface of the piston.

In the side of the cylinder is shown part of the tube, O, which forms a communication between the working and the injecting cylinders: at the end of the tube is a boss, or stout ring of metal, P, which is first screwed upon the end of the tube, and is then immoveably fixed by soft solder; this boss is pressed by means of a perforated screwed nut, Q, close against a square shoulder in the cavity made in the cylinder, and rendered water-tight by the interposition of an oiled leather ring or washer.

RR, figs. 3, 5, and 8, a cistern or reservoir for water, over which are fixed the two injecting cylinders or pumps, SS, one being one inch, and the other two inches in diameter. At the back part of the cistern are fixed two cast-iron brackets, TT, each having two holes, in which the pins or fulcrums, UU, of the working levers or handles, VV, are put; one of each of these two holes is fixed at double the distance of the other from the centre of the cylinder, by which means the fulcrum can easily be changed, when the lever is level, as the lever has two holes in it opposite to those in the bracket, and two pins are likewise necessary in this operation; for, if the pin be in the outer hole, and it is wished to remove the fulcrum, the lever must be kept level, and the other pin put into the other hole; the outer pin may then be removed, and the power will be doubled.

The brackets, TT, are likewise provided with cylindrical holes to receive the upper parts of the pistons, by which means they are kept parallel with the cylinders in use.

The middle parts of the pistons, WW, are made open, to receive the slings and levers; at the upper ends of the openings in the pistons are suspended the slings, by the pins, XX, through the piston, and the upper end of the sling: the bottom parts of the slings are made to receive the levers or handles, through which pins are inserted, forming joints with the levers, by which means the motion of the levors is communicated to the pistons.

The levers have moveable handles, YY, figs. 5 and 8, at one end, and weights, ZZ, to counterpoise them at the other end.

Figs. 12, 13, 14, 15, 16, and 17, are drawn to a scale of one inch and a half to the foot; figs. 18, 19, 20, 21, 22, 23, 24, and 25, to a scale of six inches to the foot, or one-half their real size. Fig. 12, is a section of the one inch injecting pump or cylinder, and the junction part which forms a communication between the one inch and the two inch injecting pumps. *a*, *a*, the injecting cylinder, in the bottom of which is a valve, *d*, contained in a screwed nut, *c*, which is screwed up close against a square shoulder, in a cavity at the bottom of the cylinder, and rendered water-tight by the interposition of a leather ring or washer, *b* : *e*, a tube screwed to the bottom part of the nut, having a hemispherical end, with a number of small holes in it to strain the water clear from any foreign matters which might prevent the valve from shutting close. (Fig 20, is an elevation, and fig. 21, an end view of the aforesaid valve.) *f*, the injecting piston, (the upper part of it being removed,) which is solid, and turned truly cylindrical: *g*, a perforated screwed nut, which permits the entrance of the injecting piston, *f*, and screws down the two cupped leathers, *h*, *h*, with the metal ring, *i*, interposed between them, close to a shoulder in the upper part of the injecting cylinder, and thus renders the junction between the injecting piston and its cylinder water-tight. The upper part of this nut is excavated to form a receptacle for oil. Fig. 18, is a section of the two cupped leathers, *hh*, and the metal ring, *i*, of half their real size: *kk*, fig. 12, two tubes, which form the communication between the two cylinders and the junction part. These tubes are secured in the sides of the injecting cylinders, in the manner described in the reference to fig. 10, of the press cylinder.

The other ends of the tubes are screwed into the junction part, and secured therein with soft solder: *ll*, the valves, which open and shut the communication between the injecting and the press cylinders. Above these valves are small screws, *m m*, which are screwed down to a conical shoulder on each of them, which serve to regulate their ascent, and, by the removal of which, the valves may be inspected at pleasure. On the top of each valve is a hole to screw in a pin, to lift the valve out, to be examined when neceesary. Fig. 22, is an elevation; fig. 23, a view of the upper part; and fig. 24, a section of the said valves, through the dotted line in fig. 22. Fig. 19, the screw, *m*. Fig. 13, is a section of the junction part, at right angles to fig. 12. *n*, figs. 12 and 13, the safety valve, to prevent the bursting of the tubes and cylinders, on the head of which rests the lever, *o*, graduated on its upper side, and having a weight, *p*, suspended at the other end, which can be moved to any of the notches as required. The bottom part of this valve is made conical, see fig. 25. The water-way or aperture under this valve is only 1-8th of an inch in diameter.

If the weight, *p*, be moved to the end of the lever, the distance of it from the fulcrum will be ten times as great as that of the valve; and the weight being seven pounds, the pressure on the head of the valve will be equal to seventy pounds over an aperture of 1-8th of an inch diameter, equal to the 64th part of a circular inch. Then 70 × 64 = 4480 lbs. or two tons on the circular inch. But should the force or pressure of the water become greater, the valve will instantly be lifted up, and the water will make its escape through the aperture at *q*, above the conical seat of the valve.

This valve is of great importance when the injecting piston is worked by a steam-engine, water-wheel, or any other unlimited power. *r*, figs. 13, 5, and 8, the discharging cock; this cock has a cylindrical stem, which traverses through the guide, *s*, screwed on the fore-part of the cistern: on one extremity is a small handle or lever, *t*, and the other end is formed into a screw terminated by a conical end, which can be screwed down to a conical shoulder in the side of the junction part. When this screw is loosened, it opens a communication between the press cylinder and the cistern; but, if it be screwed tight up, it effectually closes that passage, and makes the communication complete along the tube or pipe, *u*, fig. 13, and *u*, *u*, *u*, figs. 7 and 8, and is itself secured in the junction part, or the two cocks, *v*, *v*, placed between the two presses: if the cocks be screwed tight down to their conical shoulders, the communication is cut off from both the press cylinders; but, if the right-hand cock be unscrewed, the communication is open to the right-hand press cylinder; and, if the left-hand one is also unscrewed, the communication is complete to the left hand press cylinder.

Fig. 15. represents the two stop cocks, and a section through the junction part. The upper part of the cocks are screwed through the nuts *w*, *w*, which nuts secure the cupped leather, *a*, *a*. against a square shoulder, and thus render the space between the junction part, and the cocks water-tight.

The middle part of the cocks is made truly cylindrical, to pass smoothly through the leathers *x*, *x*. The two tubes which make the communication with the two press cylinders, being secured by the nuts and bosses in the bottom part of the junction part, as before described in fig. 10.

Fig. 14, is a section of a triple water-way joining screw, which is fixed at the back part of the presses, at *y*.

The tube or main *z*, may be continued on to any nnmber, of presses; or a solid plug may be put in before the nut, and made watertight.

Fig. 16, is an external view, and fig. 17, a section of two pieces of tube, or pipes, *a*, *a*, shewing the manner in which they are joined together.

These tubes are made of plate copper, one edge of the plate being hammered to an acute angle, the copper is bent round, with the acute edge towards the inside of the tube, as shewn in fig. 26, of its real size. The other, or outer edge of it, forms a square shoulder on the outside of the tube, along its whole length, which serves to hold a greater quantity of spelter-solder over the joint in in soldering it, than could otherwise be laid upon it, and also prevents it from running off the tube, when in a melted state. The broad surfaces in contact from *a* to *b*, are absolutely necessary, to enable the tube to sustain the vast pressure exerted upon it in use; namely, from 3 to 4 tons, upon each circular inch.

b, *b*, fig. 16 and 17; a boss or ring into which the two tubes *a*, *a*, are screwed, and firmly united, by soft soldering.

c, *c*, is another boss or ring, screwed and soldered on the end of the pipe *a*, the screwed nut *d*, being previously put upon it: this nut being screwed into a cavity, resembling that at *e*, on the other ends of the tubes *a*, *a*, a leather ring or washer *f*, being previously placed on the end of the pipe, before the boss *c*, *c*, will form a watertight joint: the boss *e*, *e*, being previously secured upon the end of the pipe *a*, by screwing and soldering.

These pipes are commonly made in lengths of four feet each.

The action of the press may very readily be comprehended:—suppose the space between the press piston and its cylinder, the conducting tube, and the interval between the injecting piston and its cylinder, to be filled with water, and that an adequate supply of water be included in the reservoir;—if the injecting piston be raised, the water will flow from the reservoir into the injecting cylinder, through the valve *b*, fig. 12. On the descent of the injecing piston, the valve *b*, closes, the water forces up the valve *b*, and *b*, and passes through the conducting tube into the press cylinder, where it raises the press piston, together with its load, in proportion to the quantity of fluid injected. On the subsequent rise of the injecting piston, the descent of the valve prevents the return of the fluid, and, consequently the descent of the piston, and the operation is repeated as before described.—When the full effort of the press has been exerted on the objects submitted to its action, the discharging cock *r*, is loosened; the piston then descends in consequence of its gravity, and the water returns through the aperture into the reservoir.

The mechanical effect of the pump will admit of an easy calculation. It is known, that if there be a mutual communication between two columns of any fluid, whatever pressure or effort may be exerted on the one, will be transmitted to the other, in a ratio, proportional to the respective areas of each; consequently, the relative areas of the injecting and press pistons, constitutes the hydrostatic power of the press; and the mechanical effort exerted on the injecting piston is transmitted to the press piston by the intervention of the fluid, in a ratio proportional to their comparative areas.

Let us suppose, as an example, that the diameter of the press piston be 8 inches; and that of the two injecting pistons be 2 inches, and one inch. The areas of the press, and two inch injecting pistons are proportional to the squares of their diameters, which are as 4 to 64, or as 1 to 16; those of the press and the 1 inch injecting pistons are as 1 to 64; this constitutes the hydrostatic power of the press. The mechanical power of the levers is as 1 to 10, when the pin or fulcrums are in the outer holes; and as 1 to 20, when in the others; and by the multiplication of ratios, the four hydro-mechanical powers will stand thus; 16 × 10 = 160 to 1; 16 × 20 = 320 to 1; 64 × 10 = 640 to 1; and 64 × 20 = 1280 to 1; which are in proportion to each other, as 1, 2, 4, and 8. If we therefore suppose the centre of effort on the levers, to be depressed with a force of 1 man = 168lb. 2 men will be =336 lb. or 3 cwt. ×1280= 3840 cwt. or 192 tons: the objects submitted to the action of the press will therefore sustain a pressure equal to the direct action of 192 tons.

Hydro-mechanical power is not only applicable to a press of every description, but to every thing where accumulated power is required.

The press should be kept clean and neat; the reservoir should be filled with pure water; and the best sweet oil alone should be applied to the pistons.

From the simplicity of its construction, the press is by no means liable to be out of order; but if any extraneous matter attaches itself to either of the valves, their action will necessarily be suspended, until the substance be removed; but this, it is presumed will scarcely ever be found necessary.

In using this press, it is desirable to begin with the two inch injecting pump, the pin of its lever being in the outer hole, in order to save time; when the resistance has become greater than this power can overcome, the pin, of the lever should be fixed in the inner hole and the action continued; when however this power is insufficient to overcome the resistance, recourse must be had to the 1 inch injecting pump, with the pin of its lever in the outer hole; and finally the utmost power of the press exerted, by shifting it to the inner hole.